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§ 172.240 Permeability of spaces.

When doing the calculations required in § 172.225,

(a) The permeability of a floodable space, other than a machinery or cargo space, must be assumed as listed in Table 172.240;

(b) Calculations in which a machinery space is treated as a floodable space must be based on an assumed machinery space permeability of 85% unless the use of an assumed permeability of less than 85% is justified in detail; and

(c) Calculations in which a cargo space that is completely filled is considered flooded must be based on an assumed cargo space permeability of 60% unless the use of an assumed permeability of less than 60% is justified in detail. If the cargo space is not completely filled, a cargo space permeability of 95% must be assumed unless the use of an assumed permeability of less than 95% is justified in detail.

TABLE 172.240—PERMEABILITY

Spaces and tanks	Permeability (percent)
Storeroom spaces	60
Accommodations spaces	95
Voids	95
Consumable liquid tanks	[1] 95 or 0
Other liquid tanks	[2] 95 or 0
Cargo (completely filled)	60
Cargo (empty)	95
Machinery	85

[1] Whichever results in the more disabling condition.
[2] If tanks are partially filled, the permeability must be determined from the actual density and amount of liquid carried.

§ 172.245 Survival conditions.

A vessel is presumed to survive assumed damage if it meets the following conditions in the final stage of flooding:

(a) *Final waterline.* The final waterline, in the final condition of sinkage, heel, and trim must be below the lower edge of an opening through which progressive flooding may take place, such as an air pipe, or an opening that is closed by means of a weathertight door or hatch cover. This opening does not include an opening closed by a:

(1) Watertight manhole cover;

(2) Flush scuttle;

(3) Small watertight cargo tank hatch cover that maintains the high integrity of the deck;

(4) Class 1 door in a watertight bulkhead;

(5) Remotely operated sliding watertight door;

(6) Side scuttle of the nonopening type;

(7) Retractable inflatable seal; or

(8) Guillotine door.

(b) *Heel angle.* The maximum angle of heel must not exceed 15 degrees, except that this angle may be increased to 17 degrees if no deck edge immersion occurs.

(c) *Range of stability.* Through an angle of 20 degrees beyond its position of equilibrium after flooding, a vessel must meet the following conditions:

(1) The righting arm curve must be positive.

(2) The maximum righting arm must be at least 4 inches (10 cm).

(3) Each submerged opening must be weathertight

(d) *Metacentric height.* After flooding, the metacentric height must be at least 2 inches (50 mm) when the vessel is in the equilibrium position.

(e) *Progressive flooding.* In the design calculations required by § 172.225, progressive flooding between spaces connected by pipes, ducts or tunnels must be assumed unless:

(1) Pipes within the assumed extent of damage are equipped with arrangements such as stop check valves to prevent progressive flooding to other spaces with which they connect; and,

(2) Progressive flooding through ducts or tunnels is protected against by:

(i) Retractable inflatable seals to cargo hopper gates; or

(ii) Guillotine doors in bulkheads in way of the conveyor belt.

PART 173—SPECIAL RULES PERTAINING TO VESSEL USE

Subpart A—General

Sec.
173.001 Applicability.

Subpart B—Lifting

173.005 Specific applicability.
173.007 Location of the hook load.
173.010 Definitions.
173.020 Intact stability standards: Counterballasted and non-counterballasted vessels.

Subpart C—School Ships

Subpart D—Oceanographic Research

Subpart E—Towing

AUTHORITY: 43 U.S.C. 1333; 46 U.S.C. 2113, 3306, 5115; E.O. 12234, 45 FR 58801, 3 CFR, 1980 Comp., p. 277; 49 CFR 1.46.

SOURCE: CGD 79–023, 48 FR 51045, Nov. 4, 1983, unless otherwise noted.

Subpart A—General

§ 173.001 Applicability.

Each vessel that is engaged in one of the following activities must comply with the applicable provisions of this part:

(a) Lifting.
(b) Training (schoolship).
(c) Oceanographic research.
(d) Towing.

Subpart B—Lifting

§ 173.005 Specific applicability.

This subpart applies to each vessel that—

(a) Is equipped to lift cargo or other objects; and

(b) Has a maximum heeling moment due to hook load greater than or equal to—

(0.67)(W)(GM)(F/B) in meter-metric tons (foot-long tons), where—
W=displacement of the vessel with the hook load included in metric (long) tons.
GM=metacentric height with hook load included in meters (feet).
F=freeboard to the deck edge amidships in meters (feet).
B=beam in meters (feet).

[CGD 79–023, 48 FR 51045, Nov. 4, 1983, as amended by CGD 85–080, 61 FR 945, Jan. 10, 1996]

§ 173.007 Location of the hook load.

When doing the calculations required in this subpart, the hook load must be considered to be located at the head of the crane.

§ 173.010 Definitions.

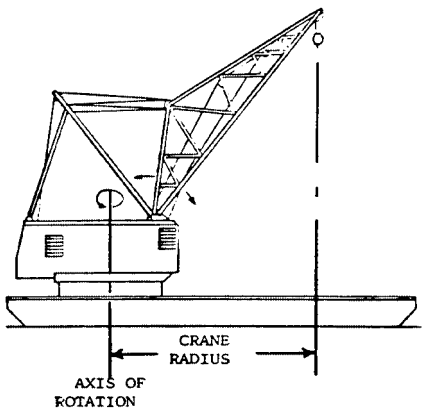
As used in this part—

(a) *Hook load* means the weight of the object lifted by the crane.

(b) *Crane radius* means the distance illustrated in Figure 173.010.

Figure 173.010

Crane Radius



§ 173.020 Intact stability standards: Counterballasted and non-counterballasted vessels.

(a) Except as provided in paragraph (c) of this section, each vessel that is not equipped to counter-ballast while

lifting must be shown by design calculations to comply with this section in each condition of loading and operation and at each combination of hook load and crane radius.

(b) Each vessel must have a righting arm curve with the following characteristics:

(1) If the vessel operates in protected or partially protected waters, the area under the righting arm curve up to the smallest of the following angles must be at least 10 foot-degrees (3.05 meter-degrees):

(i) The angle corresponding to the maximum righting arm.

(ii) The downflooding angle.

(iii) 40 degrees.

(2) If the vessel operates in exposed waters, the area under the righting arm curve up to the smallest of the following angles must be at least 15 foot-degrees (4.57 meter-degrees):

(i) The angle corresponding to the maximum righting arm.

(ii) The downflooding angle.

(iii) 40 degrees.

(c) If the vessel's hull proportions fall within all three of the following limits, in lieu of complying with paragraph (b) of this section, the vessel owner may demonstrate in the presence of the OCMI that the vessel will not heel beyond the limits specified in paragraph (d) of this section:

(1) Beam to depth—3.40 to 4.75.

(2) Length to beam—3.20 to 4.50.

(3) Draft to depth—0.60 to 0.85.

(d) For the purpose of paragraph (c) of this section, the following limits of heel apply with the vessel at its deepest operating draft:

(1) Protected and partially protected waters and Great Lakes in summer—heel to main deck immersion or bilge emergence, whichever occurs first.

(2) Exposed waters and Great Lakes in winter—heel permitted to one-half of the freeboard or one-half of the draft, whichever occurs first.

[CGD 79–023, 48 FR 51045, Nov. 4, 1983, as amended by CGD 85–080, 61 FR 945, Jan. 10, 1996]

§ 173.025 Additional intact stability standards: Counterballasted vessels.

(a) Each vessel equipped to counterballast while lifting must be shown by design calculations to be able to withstand the sudden loss of the hook load, in each condition of loading and operation and at each combination of hook load and crane radius.

(b) When doing the calculations required by this section, the hook load and counterballast heeling arms and vessel righting arms, as plotted on graph 173.025, must define areas that satisfy the following equation:

Area II > Area I + K

Where—

(1) K=O for operation on protected waters and 7 foot-degrees (2.13 meter-degrees) for operation on partially protected and exposed waters.

(2) Areas I and II are shown on graph 173.025.

(c) Each heeling arm curve must be defined by—

HA=HAO cos (T)

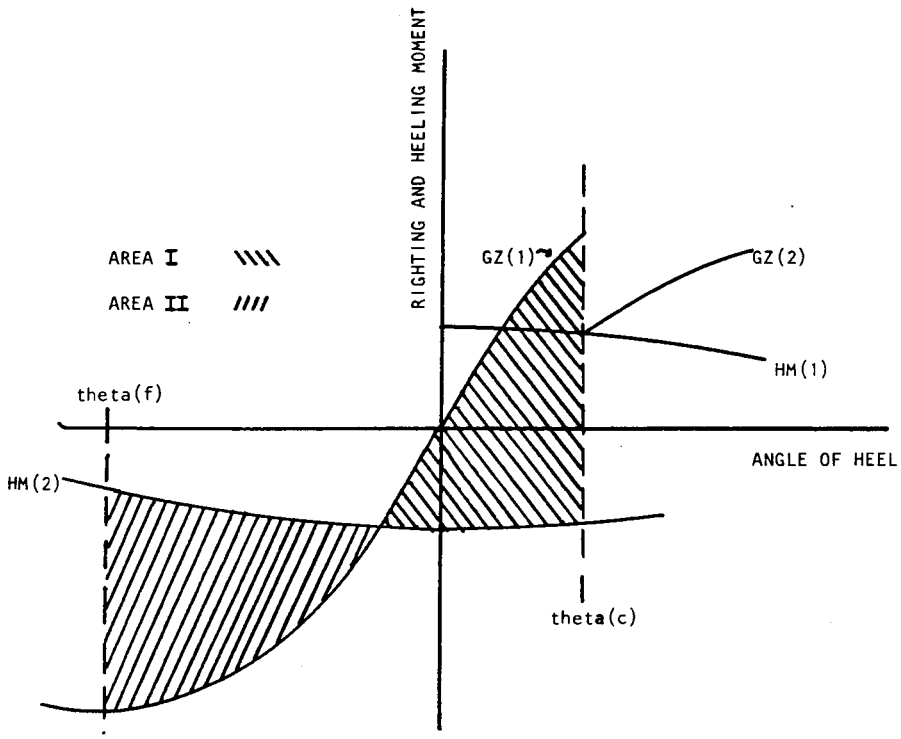
Where—

HA=heeling arm.

HAO=heeling arm at 0 degrees of heel.

T=angle of heel.

GRAPH 173.025



Where—

GZ(1) is the righting arm curve at the displacement corresponding to the vessel without hooking load.

GZ(2) is the righting arm curve at the displacement corresponding to the vessel with hook load.

HA(1) is the heeling arm curve due to the combined heeling moments of the hook load and the counterballast at the displacement with hook load.

HA(2) is the heeling arm due to the counterballast at the displacement without hook load.

Theta(c) is the angle of static equilibrium due to the combined hook load and counterballast heeling moments.

Theta(f) is the downflooding angle on the counterballasted side of the vessel.

[CGD 79–023, 48 FR 51045, Nov. 4, 1983, as amended by CGD 85–080, 61 FR 945, Jan. 10, 1996]

Subpart C—School Ships

§ 173.050 Specific applicability.

Each nautical school ship, inspected under Subchapter R of this chapter, must comply with this subpart.

§ 173.051 Public nautical school ships.

Each public nautical school ship must comply with—

(a) Section 171.070(a) of this subchapter as a passenger vessel carrying 400 or less passengers;

(b) Section 171.070(e) of this subchapter;

(c) Section 171.072 of this subchapter; and

(d) Section 171.073 of this subchapter.

[CGD 79–023, 48 FR 51045, Nov. 4, 1983. Redesignated by CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.052 Civilian nautical school ships.

Each civilian nautical school ship must comply with part 171 of this subchapter as though it were a passenger vessel. In addition to regular passengers, for the purpose of complying with part 171, the following will also count as passengers;

(a) A student.

(b) A cadet.

(c) An instructor who is not also a member of the crew.

[CGD 79–023, 48 FR 51045, Nov. 4, 1983. Redesignated by CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.053 Sailing school vessels.

(a) In addition to the requirements in §§ 173.054 through 173.063, each sailing school vessel must comply with the provisions of subpart A of part 171 of this subchapter.

(b) In addition to regular passengers, for the purpose of complying with §§ 171.070 through 171.073 and § 171.080, the following will also be counted as passengers:

(1) Sailing school students.

(2) Sailing school instructors.

(3) Guests.

[CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.054 Watertight subdivision and damage stability standards for new sailing school vessels.

(a) Each new sailing school vessel which has a mean length greater than 75 feet (22.8 meters) *or* which carries more than 30 persons must comply with—

(1) Section 179.210(a) of this chapter;

(2) Sections 171.070 through 171.073; and

(3) Section 171.080 for Type II subdivision and damage stability.

(b) Each new sailing school vessel which has a mean length of 75 feet (22.8 meters) or less and carries more than 30 persons must comply with either—

(1) Section 179.210(a) of this chapter and § 179.220 of this chapter; or

(2) Section 171.040(a)(1), §§ 171.070 through 171.073, and § 171.080.

(c) Each new sailing school vessel which does not carry more than 30 persons must have a collision bulkhead unless it has a mean length less than 40 feet (12.2 meters) and is certificated for protected or partially protected waters service only.

[CGD 83–005, 51 FR 924, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 946, Jan. 10, 1996]

§ 173.055 Watertight subdivision and damage stability standards for existing sailing school vessels.

(a) Except as provided in paragraph (c) of this section, an existing sailing school vessel which carries more than 49 persons must be fitted with a collision bulkhead and any additional bulkheads necessary to provide one compartment subdivision.

(b) Except as provided in paragraph (c) of this section, an existing sailing school vessel which has a mean length greater than 65 feet (19.8 meters), must be fitted with additional transverse watertight bulkheads necessary to provide one compartment subdivision, when the following Subdivision Numerals are exceeded:

(1) For vessels to be operated on Exposed Waters:

$L \times N > 4000$

(2) For vessels to be operated on Partially Protected Waters:

$L \times N > 4500$

(3) For vessels to be operated on Protected Waters:

$L \times N > 5000$

where L is the mean length and N is the number of persons on board

(c) An existing sailing school vessel which is required to meet a one compartment subdivision standard and has a mean length of 90 feet (27.4 meters) or less may, instead of one compartment subdivision, be fitted with a collision bulkhead and sufficient air tankage or other internal buoyancy to maintain the fully-loaded vessel afloat with positive stability in the flooded condition.

(d) Except as provided in paragraph (e) of this section, an existing sailing school vessel which has a mean length greater than 65 feet (19.8 meters) must be fitted with a collision bulkhead.

(e) On an existing sailing school vessel, operating on protected waters, which has a mean length of 90 feet (27.4 meters) or less with no other requirement for subdivision, the collision bulkhead may be omitted.

(f) An existing sailing school vessel, operating on exposed waters, which has a mean length of 65 feet (19.8 meters) or less and is carrying more than 15 persons, must be fitted with a collision bulkhead.

[CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.056 Collision and other watertight bulkheads.

(a) Collision bulkheads required by this section must comply with the requirements in §171.085 of this subchapter.

(b) Each sailing school vessel required to meet paragraph (a) of §173.054 must comply with the machinery space bulkhead requirements in §171.095 of this subchapter.

[CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.057 Permitted locations for Class I watertight doors.

(a) Class I doors are permitted in any location on a sailing school vessel which has a mean length of 125 feet (38.1 meters) or less.

(b) Class I doors fitted in accordance with §170.270 of this subchapter shall additionally be marked in two-inch letters ''RECLOSE AFTER USE'', and be provided with a remote position indicator at the main navigating station of the vessel.

[CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.058 Double bottom requirements.

Each new sailing school vessel which has a mean length greater than 165 feet (50.3 meters) and is certificated for exposed water service must comply with the double bottom requirements in §§171.105 through 171.109, inclusive, of this subchapter.

[CGD 83–005, 51 FR 924, Jan. 9, 1986]

§ 173.059 Penetrations and openings in watertight bulkheads.

Penetrations and openings in watertight bulkheads must comply with the requirements in subpart E of part 171 of this subchapter or §§179.320, 179.330, and 179.340 in subchapter T of this chapter.

[CGD 83–005, 51 FR 924, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 946, Jan. 10, 1996]

§ 173.060 Openings in the side of a vessel below the bulkhead or weather deck.

(a) Openings in the side of a vessel below the bulkhead or weather deck must comply with the requirements in subpart F of part 171 of this subchapter or §179.350 in subchapter T of this chapter.

(b) In addition to the requirements in paragraph (a) of this section, each sailing school vessel which has a mean length greater than 90 feet must comply with the requirements in §56.50–95 of Subchapter F of this chapter.

[CGD 83–005, 51 FR 924, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 945, Jan. 10, 1996]

§ 173.061 Watertight integrity above the margin line.

The watertight integrity of each sailing school vessel above the margin line must comply with the requirements in subpart G of part 171 of this subchapter or §179.360 in subchapter T of this chapter.

[CGD 83–005, 51 FR 925, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 946, Jan. 10, 1996; 61 FR 20556, May 7, 1996]

§ 173.062 Drainage of weather deck.

The weather deck of each sailing school vessel must be provided with drainage in accordance with the requirements in subpart H of part 171 of this subchapter or subpart D of part 178 in subchapter T of this chapter.

[CGD 83–005, 51 FR 925, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 946, Jan. 10, 1996]

§ 173.063 Intact stability requirements.

(a) Except as provided in this section, each sailing school vessel must meet the intact stability requirements in §§170.170, 171.050, and 171.055 of this chapter.

(b) In applying the requirements in §§170.170 and 171.050 of this subchapter, the value of ''T'' is equal to the angle of heel at which the deck edge is immersed or ⅓ of the downflooding angle, whichever is less.

(c) In applying the requirements of §171.055(d) (1) and (2) of this subchapter—

(1) The value ''X'' is equal to 0.6 long tons/square foot (9.8 metric tons/square meter).

(2) For a vessel in service on protected or partially protected waters, values ''Y'' and ''Z'' are determined from graphs 173.063 (a) and (b) and multiplied by the multiplier in graph 173.063(e).

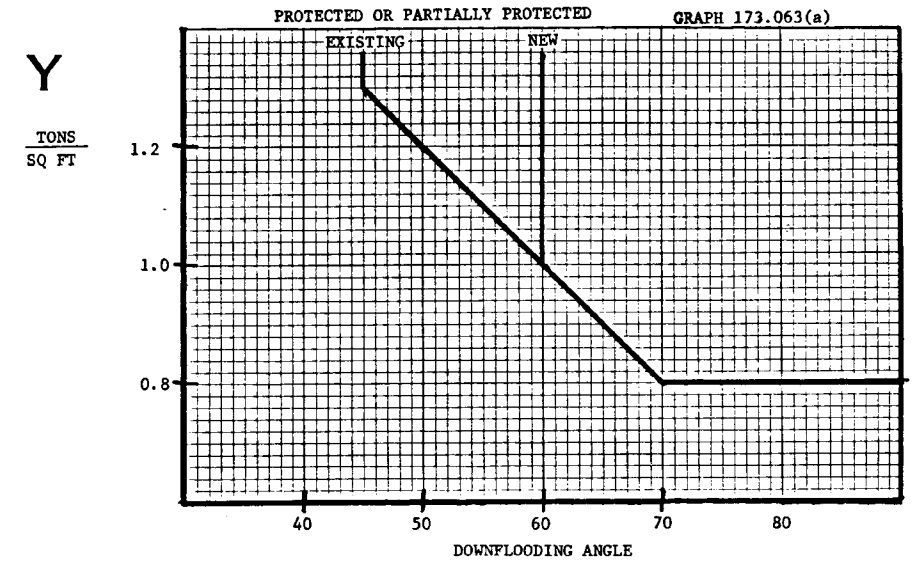
(3) For a vessel in service on exposed waters, ''Y'' and ''Z'' are determined from graphs 173.063 (c) and (d) and multiplied by the multiplier from graph 173.063(e).

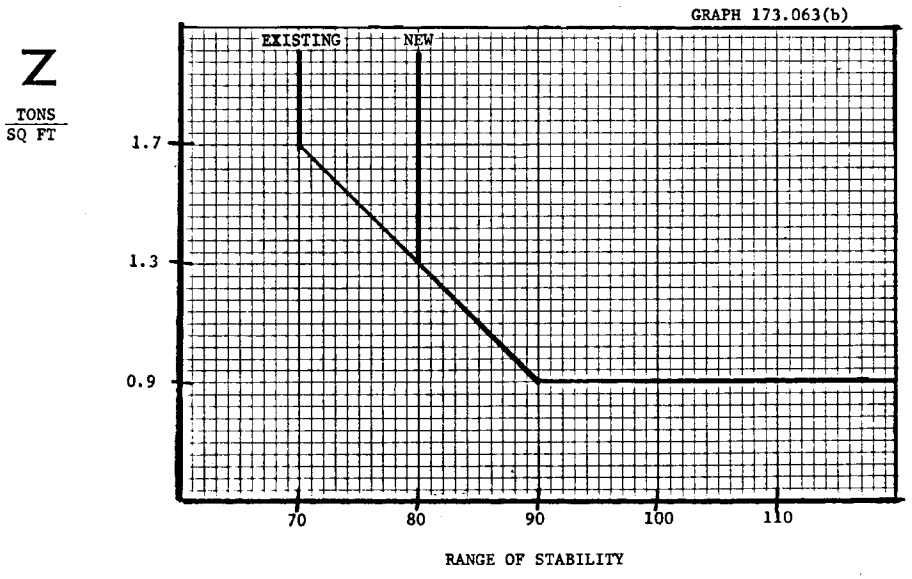
(4) To convert required numerals to units of ''metric tons/square meter,'' multiply by 10.94.

(d) Each vessel of the open boat type that is required to comply with the requirements in §§178.300 and 178.310 of this chapter, may instead comply with the requirements in paragraph (e) of this section.

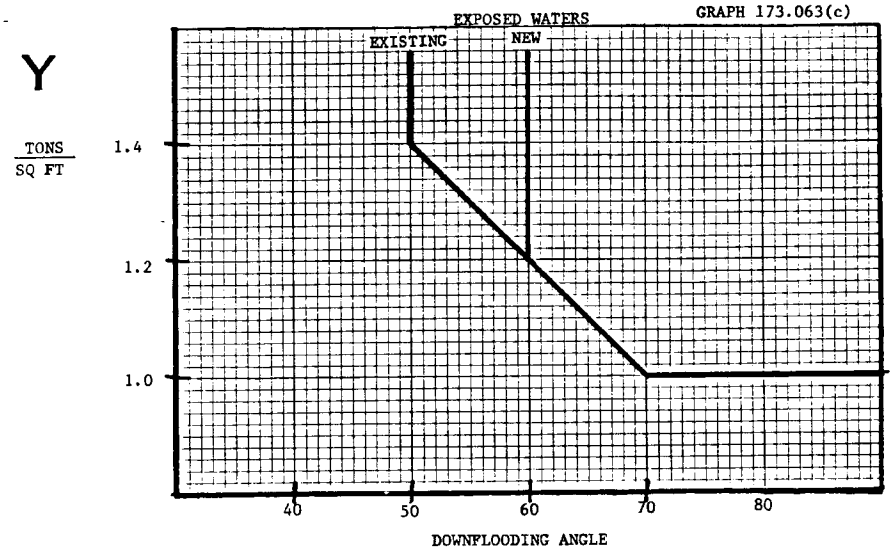
(e) In lieu of complying with the requirements of paragraph (b) of this section, an open boat may be provided with sufficient air tankage or other internal buoyancy to maintain the vessel afloat when the vessel is completely flooded or capsized. If foam is used to comply with this paragraph, it must be installed in accordance with the requirements in §170.245 of this subchapter.

(f) A sailing school catamaran must meet the intact stability requirements in §171.057.

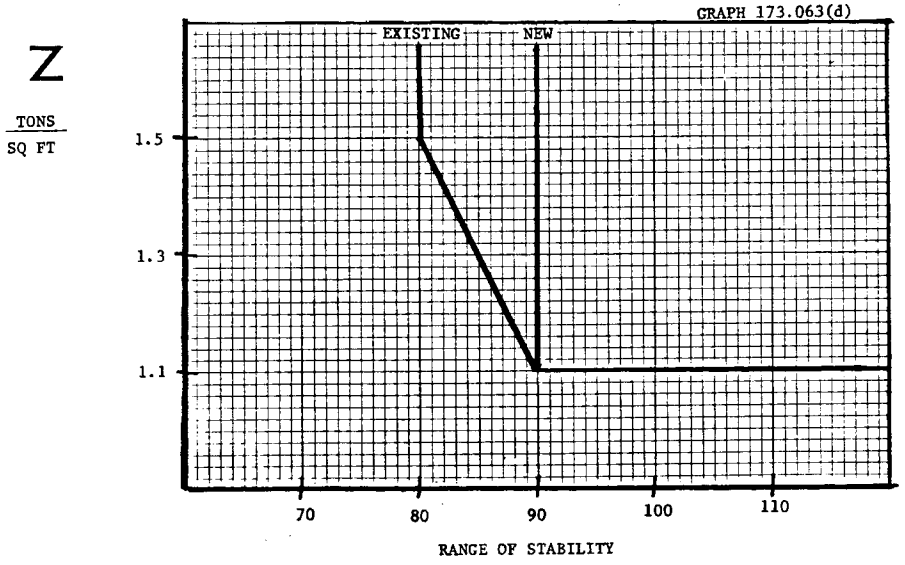

PROTECTED OR PARTIALLY PROTECTED
GRAPH 173.063(a)
EXISTING
NEW
Y
TONS
SQ FT
1.2
1.0
0.8
40
50
60
70
80
DOWNFLOODING ANGLE

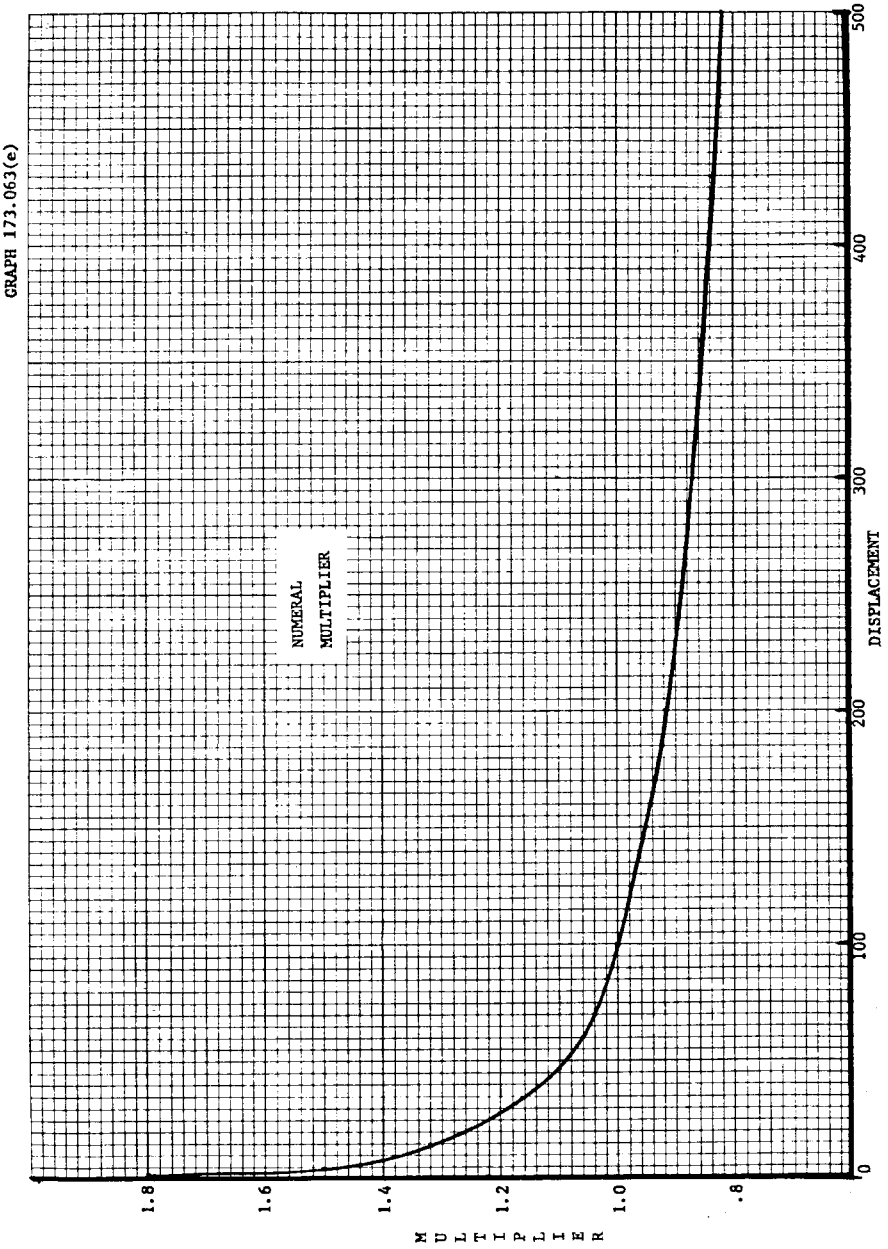

GRAPH 173.063(b)
EXISTING
NEW
Z
TONS
SQ FT
1.7
1.3
0.9
70
80
90
100
110
RANGE OF STABILITY

GRAPH 173.063(c)



GRAPH 173.063(d)





[CGD 83–005, 51 FR 925, Jan. 9, 1986, as amended by CGD 85–080, 61 FR 946, Jan. 10, 1996]

Subpart D—Oceanographic Research

§ 173.070 Specific applicability.

Each oceanographic vessel, inspected under Subchapter U of this chapter, except a barge that is less than 300 gross tons, must comply with this subpart.

§ 173.075 Subdivision requirements.

(a) Each oceanographic vessel must comply with the subdivision requirements in §§ 171.070, 171.072, and 171.073 of this subchapter as if it were a passenger vessel carrying 400 or less passengers.

(b) Each vessel must have a collision bulkhead.

§ 173.080 Damage stability requirements.

Each oceanographic vessel must comply with § 171.080 of this subchapter as a category Z vessel.

§ 173.085 General subdivision requirements.

Each oceanographic vessel must comply with the following:

(a) Section 171.085(c)(1), (d) and (g) of this subchapter.

(b) Section 171.105 (a) through (g) of this subchapter except that a reduction or elimination of the required inner bottom is allowed if—

(1) The inner bottom would interfere with the mission of the vessel; and

(2) As a result of other design features, the ability of the vessel to withstand side and bottom damage is not reduced.

(c) Section 171.106 of this subchapter.

(d) Section 171.108 of this subchapter.

(e) Section 171.109 of this subchapter.

(f) Section 171.111 of this subchapter.

(g) Section 171.113 of this subchapter.

(h) The collision bulkhead must not be penetrated by more than one pipe that carries liquid to or from the forepeak tank. This pipe must have a screwdown valve that is—

(1) Operative from above the bulkhead deck; and

(2) Attached to the bulkhead inside the forepeak tank.

(i) Section 171.116 (b), (c), and (e) of this subchapter.

(j) Section 171.117(c) of this subchapter.

(k) Each port light in a space located below the freeboard deck, as defined in § 42.13–15(i) of this chapter, or in a space within an enclosed superstructure must be fitted with a hinged inside dead cover.

(l) Section 171.118 (b) and (c) of this subchapter.

(m) Section 171.122 (a) through (d) and (f) of this subchapter.

(n) Section 171.135 of this subchapter.

(o) A ventilation duct or forced draft duct may not penetrate a main transverse watertight bulkhead unless—

(1) The penetration is watertight;

(2) The penetration is located as near the vessel's centerline as possible; and

(3) The bottom of the duct is not more than—

(i) 18 inches (45.7 cm) below the bulkhead deck; and

(ii) 4 feet (121.9 cm) above the final waterline after damage determined in § 173.080.

Subpart E—Towing

§ 173.090 General.

This subpart applies to each vessel that is equipped for towing.

§ 173.095 Towline pull criterion.

(a) In each towing condition, each vessel must be shown by design calculations to meet the requirements of either paragraph (b) or (c) of this section.

(b) The vessel's metacentric height (GM) must be equal to or greater than the following:

$$GM = \frac{(N)(P \times D)^{2/3}(s)(h)}{K\Delta(f / B)}$$

where—

N=number of propellers.

P=shaft power per shaft in horsepower (kilowatts).

D=propeller diameter in feet (meters).

s=that fraction of the propeller circle cylinder which would be intercepted by the rudder if turned to 45 degrees from the vessel's centerline.

h=vertical distance from propeller shaft centerline at rudder to towing bitts in feet (meters).

Δ=displacement in long tons (metric tons).

f=minimum freeboard along the length of the vessel in feet (meters).

B=molded beam in feet (meters).

K=38 in English units.
K=13.93 in metric units.

(c) When a heeling arm curve, calculated in accordance with paragraph (d) of this section, is plotted against the vessel's righting arm curve—

(1) Equilibrium must be reached before the downflooding angle; and

(2) The residual righting energy must be at least 2 foot-degrees (.61 meter-degrees) up to the smallest of the following angles:

(i) The angle of maximum righting arm.

(ii) The downflooding angle.

(iii) 40 degrees.

(d) The heeling arm curve specified in paragraph (c) of this section must be calculated by the following equation:

$$HA = \frac{2\,(N)(P \times D)^{2/3}(s)(h)(\cos\theta)}{K\Delta}$$

where—

HA=heeling arm.
θ=angle of heel.
N, P, D, K, s, h, and Δ are as defined in paragraph (b) of this section.

(e) For the purpose of this section, downflooding angle means the static angle from the intersection of the vessel's centerline and waterline in calm water to the first opening that does not close watertight automatically.

(f) For the purpose of this section, at each angle of heel, a vessel's righting arm may be calculated considering either—

(1) The vessel is permitted to trim free until the trimming moment is zero; or

(2) The vessel does not trim as it heels.7

PART 174—SPECIAL RULES PERTAINING TO SPECIFIC VESSEL TYPES

Subpart A—General

Sec.

Subpart B—Special Rules Pertaining to Deck Cargo Barges

Subpart C—Special Rules Pertaining to Mobile Offshore Drilling Units

Subpart D [Reserved]

Subpart E—Special Rules Pertaining to Tugboats and Towboats

Subpart F [Reserved]

Subpart G—Special Rules Pertaining to Offshore Supply Vessels

Subpart H—Special Rules Pertaining to Liftboats

Subpart I—Hopper Dredges With Working Freeboard Assignments